

Half way between the eye and the gills was an orifice and canal leading to the mouth. The gills five in number on each side.

The fins, and also their situation, are particularly described.

Adjacent to the anal fins are placed two holders for the purpose of grasping the female, terminated by a flat, sharp, bony process five inches long, which moves on a joint, and is, in fact, the termination of a series of parts corresponding to the pelvis, femur, tibia, and foot of quadrupeds.

The pectoral fins also correspond in some measure to the anterior extremities, and are connected by cartilages, which answer the same purposes as the scapulæ and sternum of quadrupeds.

The heart was not larger than that of a bullock, with three valves at the origin of the pulmonary artery, three at the entrance of the aorta, and also two sets more, of three each, in the course of the artery, at a short distance from each other.

The stomach contained several pails full of pebbles, a quantity of mucus, and a small portion of substance that looked like the spawn of the oyster.

Beside the cardiac and pyloric portions of the stomach observable in other sharks, there was a globular cavity communicating with the pyloric portion by a very small orifice, and by another, equally small, with the intestine.

The liver of this fish yielded about three hogsheads of oil. The vessels of the liver were large enough to admit a man's arm. The bile is conveyed direct to the intestine by twelve hepatic ducts, for there is no gall-bladder.

Although the *Squalus* here described resembles, in many respects, the tribe of Sharks, it is observed to differ essentially in the form of its stomach, which is intermediate between that of the shark and whale.

In the modes of generation, also, as well as in the stomachs, a series of gradations may be observed from whales through the *squalus*, sharks, rays, and skates, to the proper fishes; but this inquiry will form the subject of a future communication.

Mr. Home closes the present account by such particulars as he could collect concerning a large fish thrown ashore on one of the Orkneys, and described as a sea-snake by those who had seen it half putrid and half devoured by sea-fowl; but it was ascertained by Mr. Home to be in reality another specimen of the same *Squalus* as that above described.

On an Improvement in the Manner of dividing astronomical Instruments.
By Henry Cavendish, Esq. F.R.S. Read May 18, 1809. [*Phil. Trans.* 1809, p. 221.]

The use of the common beam-compass for dividing having been justly objected to, on account of the danger of bruising the divisions which have been made, by replacing the points of the compass into

them, the author proposes a means of obviating that inconvenience, by substituting a microscope instead of one of the points; and he describes a method of proceeding, in which there is no need ever to set the other point into any division already made.

The beam to be employed for this purpose must have a fixed point at one extremity, and at the other a centre of motion, round which the length of the beam may revolve as radius. A microscope is to slide in a groove along the middle to any required distance from the point; and in order that these may both be over the circle at the same time, the centre of motion must be capable of adjustment, that it may be fixed at a greater or less distance from the centre of the circle, according to the magnitude of the arc intercepted between the point and microscope.

In dividing by continual bisection, the microscope is first to be removed from the point to a distance nearly equal to the chord of the half-arc; and when the centre of motion has been duly adjusted, and the wire of the microscope is made to bisect the dot at one extremity, a faint scratch must be made with the point.

The beam having next been turned half round, and the dot at the other extremity brought under the wire of the microscope, a second scratch is made with the point, which, if the distance has been taken, will be very near the former; and the wire of the microscope will easily be placed midway between them in the further process of bisection, which is again performed in the same manner, after the position of the microscope and of the centre of motion have been duly altered.

In laying down the real divisions from the marks thus made, the centre of motion must be so placed that the whole length of the beam may become a tangent to the circle; and when the microscope has been fixed close to the point, and the first dot brought under it, the first division is to be marked, and the rest in succession till all are made.

Since the entire arc of a circle cannot be divided to degrees without trisection and quinquesection, Mr. Cavendish describes three methods of quinquesection, which it would be difficult to render intelligible without reference to the figures which accompany his paper; and he also makes an estimate of the comparative accuracy attainable in bisection, trisection, and quinquesection.

As it would be difficult to place the centre of motion accurately, so that the point and axis of the microscope shall both be in the circle in which the divisions are made, it becomes necessary that the wire of the microscope should be placed truly at right angles to the length of the beam; for then, although the point of intersection of the circle with the wire of the microscope is not accurately in the middle of the wire, still, when the beam is reversed, the point of intersection will lie at an equal distance on the opposite side of the centre, and will consequently be at a given distance from the fixed point of the compass.

In describing the apparatus, Mr. Cavendish has not entered further than was necessary to explain the principle, and has left the completion of it to the skill of any artist who may choose to adopt it.

On a Method of examining the Divisions of astronomical Instruments.
By the Rev. William Lax, A.M. F.R.S. Lowndes's Professor of Astronomy in the University of Cambridge. In a Letter to the Rev. Dr. Maskelyne, F.R.S. Astronomer Royal. Read June 1, 1809. [*Phil. Trans.* 1809, p. 232.]

Since the utmost precision in making astronomical observations, and in reading off the indication given by any instrument, will be of no avail if the instrument itself be not divided with proportional accuracy, the author felt the importance of *estimating* the *probable* amount of errors that might occur in Bird's method of dividing by continual bisection, and has also contrived a method of examining the divisions of any circle, and of measuring, within certain limits, the actual errors in every part of it.

The apparatus by which this examination is effected, is first minutely described, and consists of a brass arc, rather more than 90° in length, placed concentric with the circle to be examined, and firmly attached to the frame which supports the microscopes. On this arc an upright pillar is made to slide, carrying a micrometer microscope, which may thus be fixed at any distance not exceeding 90° from one of the microscopes belonging to the circular instrument; and as the position of the microscope is inclined, it may be made to point to the same division upon the circle that is under the micrometer itself.

In the process of examination which follows, the position of the point of 180° having been first ascertained by means of the opposite micrometers belonging to the instrument, the arcs of 90° on each side are next examined by the moveable microscope, and the errors noted accordingly + or -. The microscope is then placed at the distance of 60° from the micrometer, and the first sextant is thus compared with every succeeding arc of 60° in the circle; and in the same manner, the first octant is compared with every succeeding arc of 45° , and the first arc of 30° with so many of the succeeding arcs of 30° as are necessary for determining each 15° of the whole circle.

The next intervals employed by Mr. Lax are those of 5° and 3° , from which, and from their multiples, the value of 1° , 2° , and 4° , are derived; and, in a similar manner, all the succeeding intervals down to the smallest interval to which the circle happens to be divided.

However, since the method of examination itself is liable to some error, the author computes the extent to which this may possibly amount; and upon a circle of one foot radius, he finds the greatest aggregate error to which he could be liable, in points most remotely deduced, might be $9''\cdot63$: but in a circle of three feet radius, the error would be reduced to $3''\cdot21$; and with glasses of higher magnifying power, and by frequent repetition of the reading off, the true